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Kumakura

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[54] **TERMINAL PRESS-FITTING CONSTRUCTION IN CONNECTOR HOUSING**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **439/733.1**; 439/752.5; 439/869

[58] **Field of Search** 439/752.5, 733.1, 439/680, 869, 444, 603, 751

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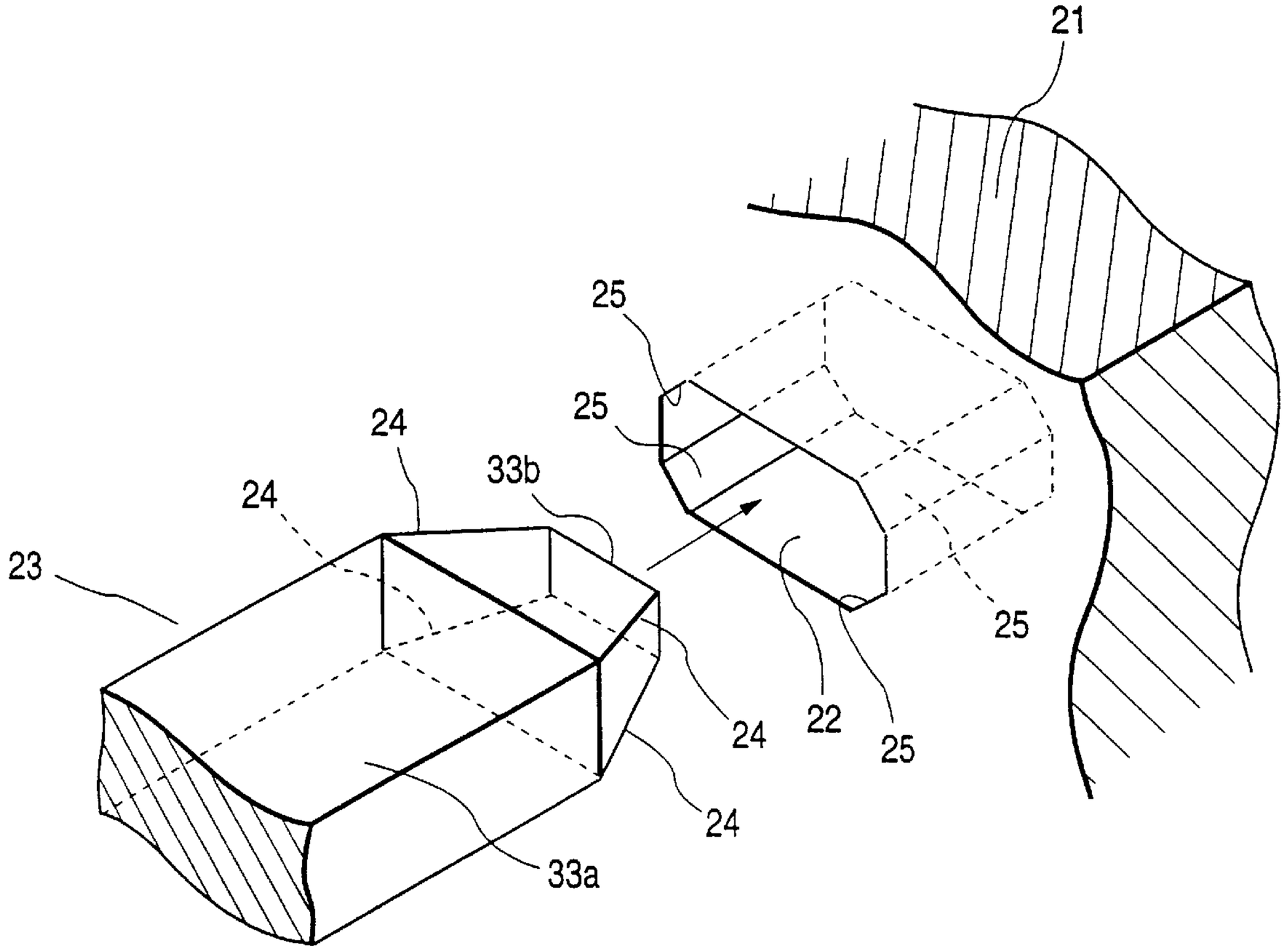
Primary Examiner—Paula Bradley
Assistant Examiner—Edwin A. Leon
Attorney, Agent, or Firm—Sughrue, Mion, Zinn, Macpeak & Seas, PLLC

[57] **ABSTRACT**

A terminal press-fitting construction in a connector housing includes terminal press-fitting open holes **22**, formed in the connector housing **21**, and terminals **23** inserted respectively in the terminal press-fitting open holes **22** in a press-fitted manner. Chamfered portions **25** are formed on an inner surface of the terminal press-fitting open hole **22**, and four corner portions **24** of the male tab-like terminal **23** abut respectively against the chamfered portions **25** to slide respectively on these chamfered portions during a press-fitting operation so that the corner portions **24** can achieve a press-fitting effect. An opening of the terminal press-fitting open hole **22**, when viewed in a direction of an axis thereof, has a polygonal shape (i.e., octagonal shape) having sides twice larger in number than the corner portions **24**. The terminal **23** is inserted into this press-fitting open hole.

3 Claims, 7 Drawing Sheets



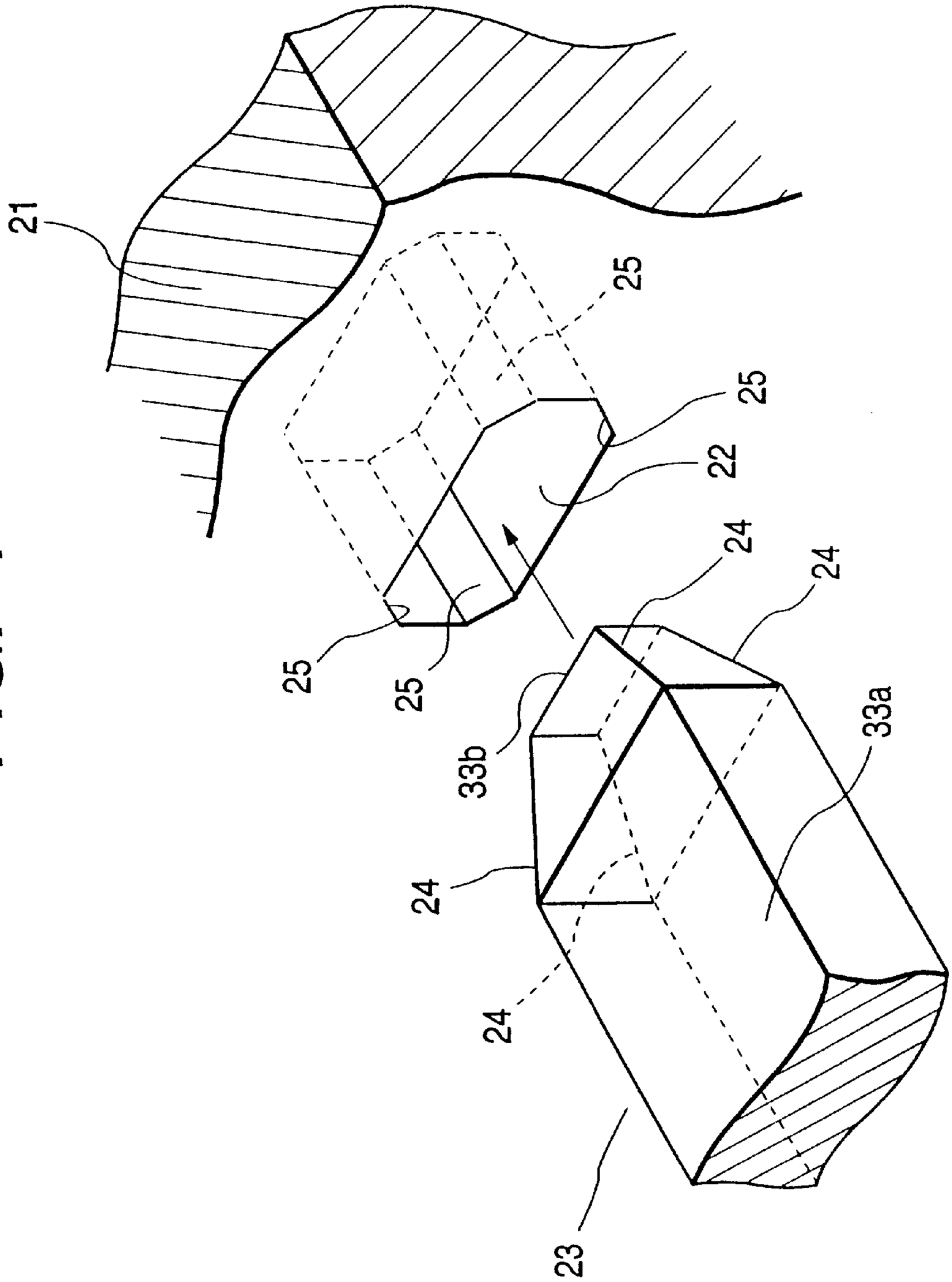


FIG. 1

FIG. 2(a)

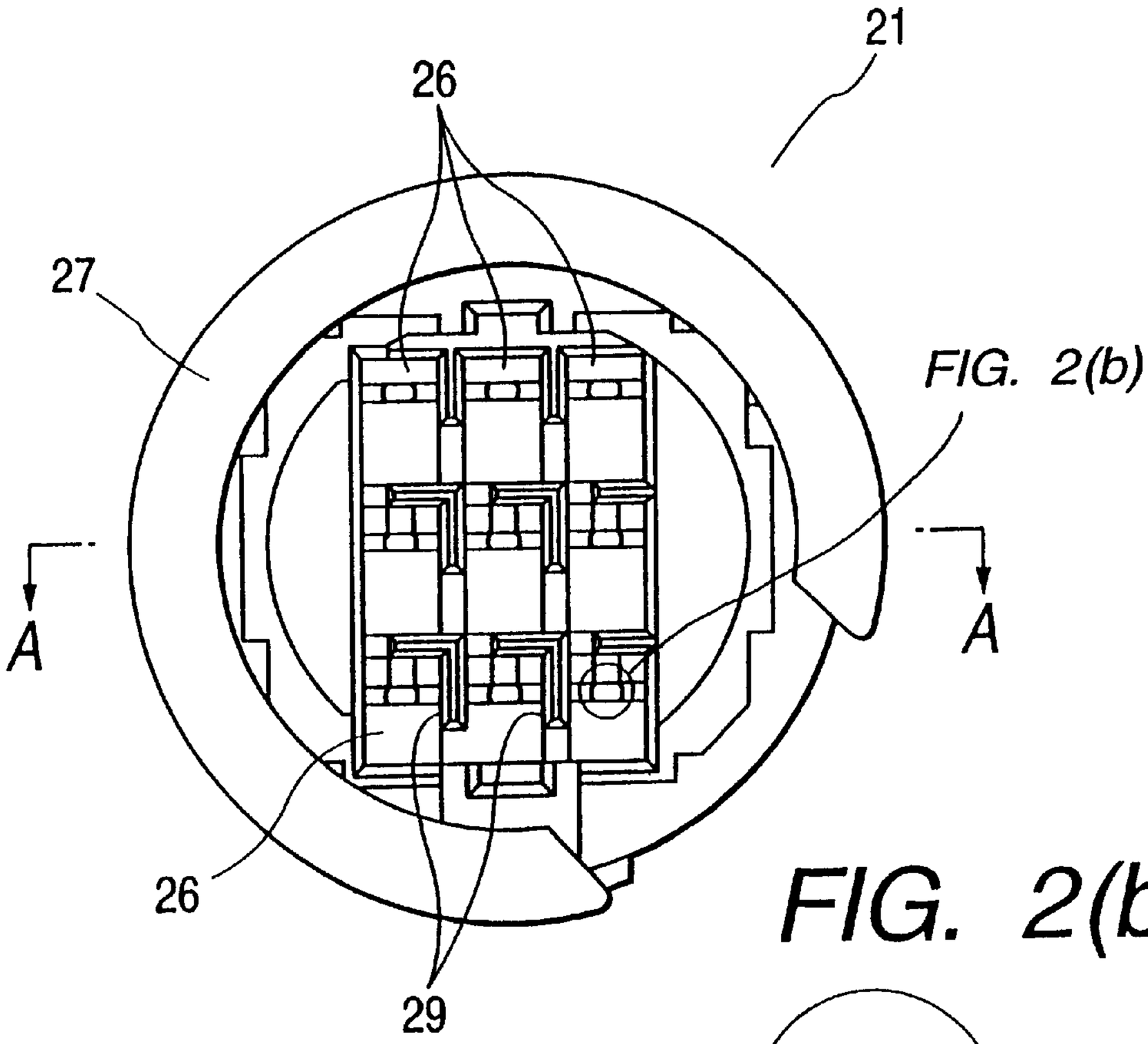
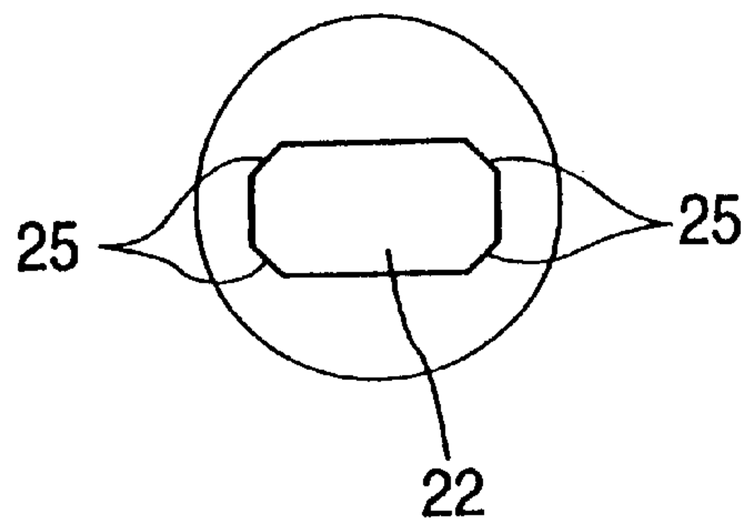


FIG. 2(b)



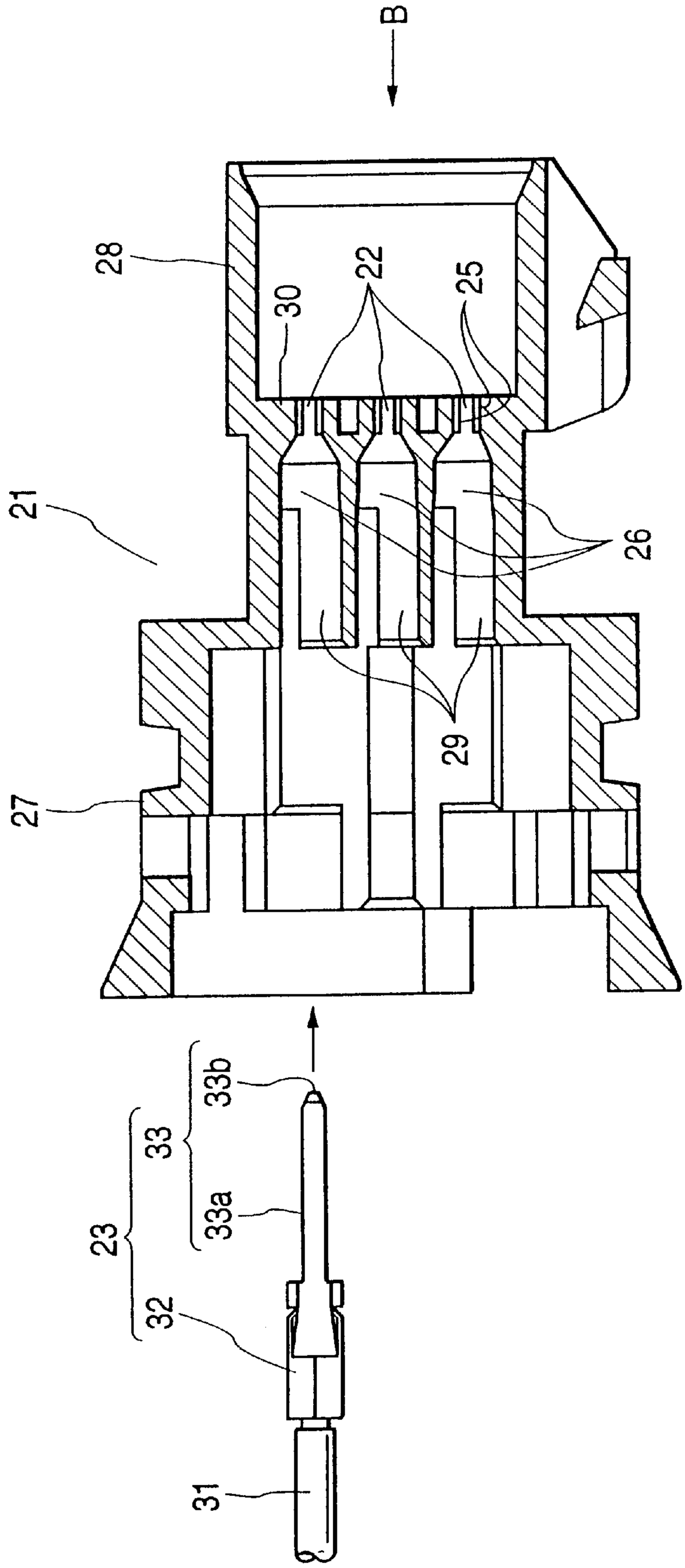


FIG. 3

FIG. 4(a)

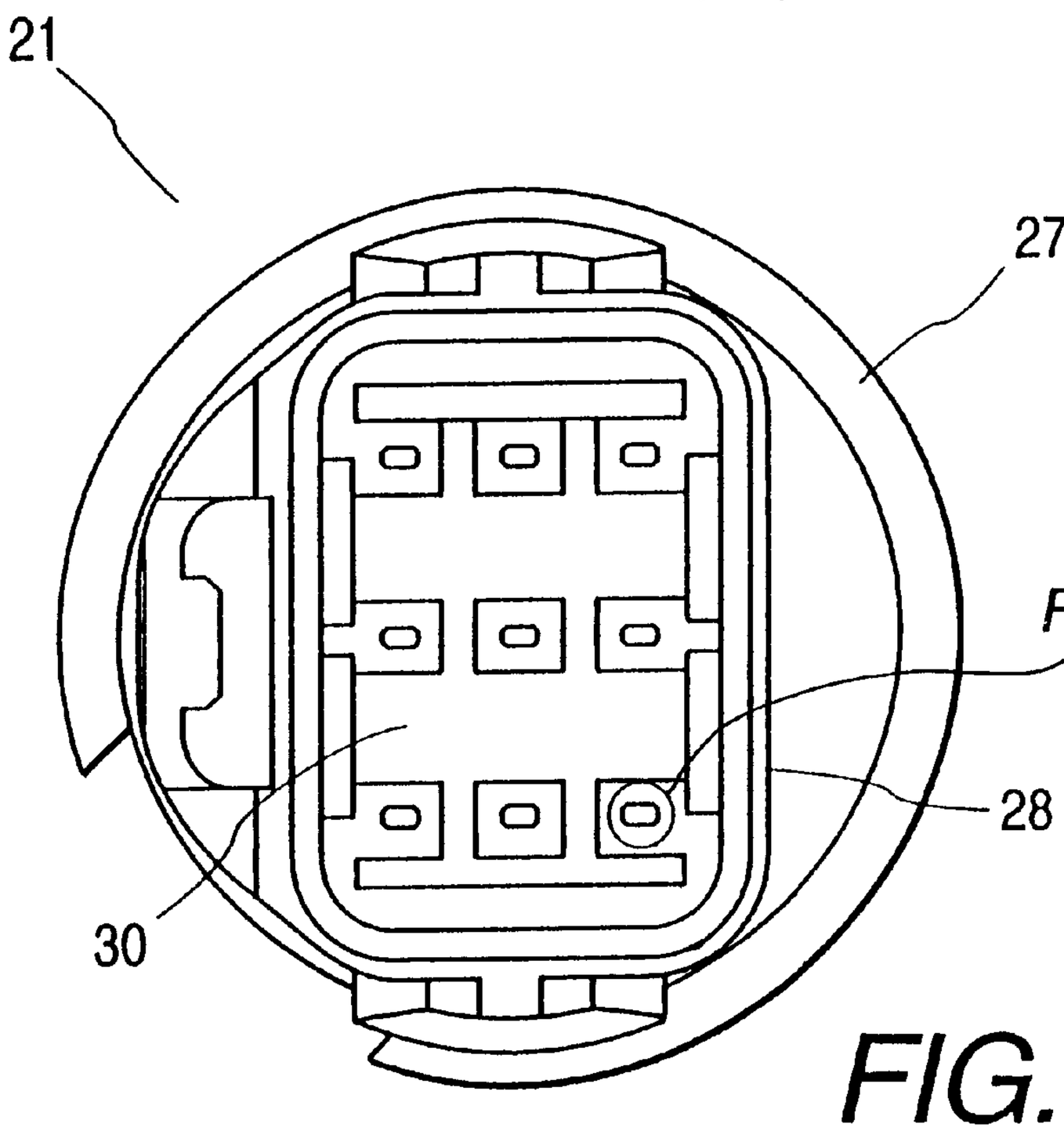


FIG. 4(b)

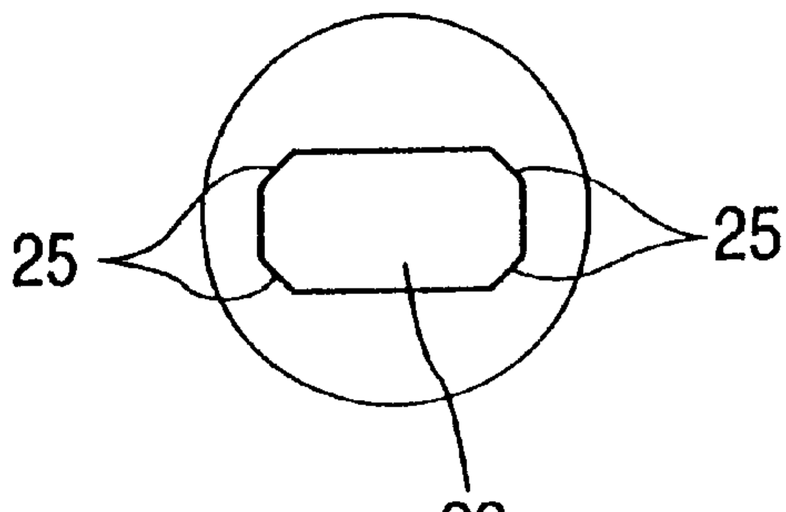


FIG. 5

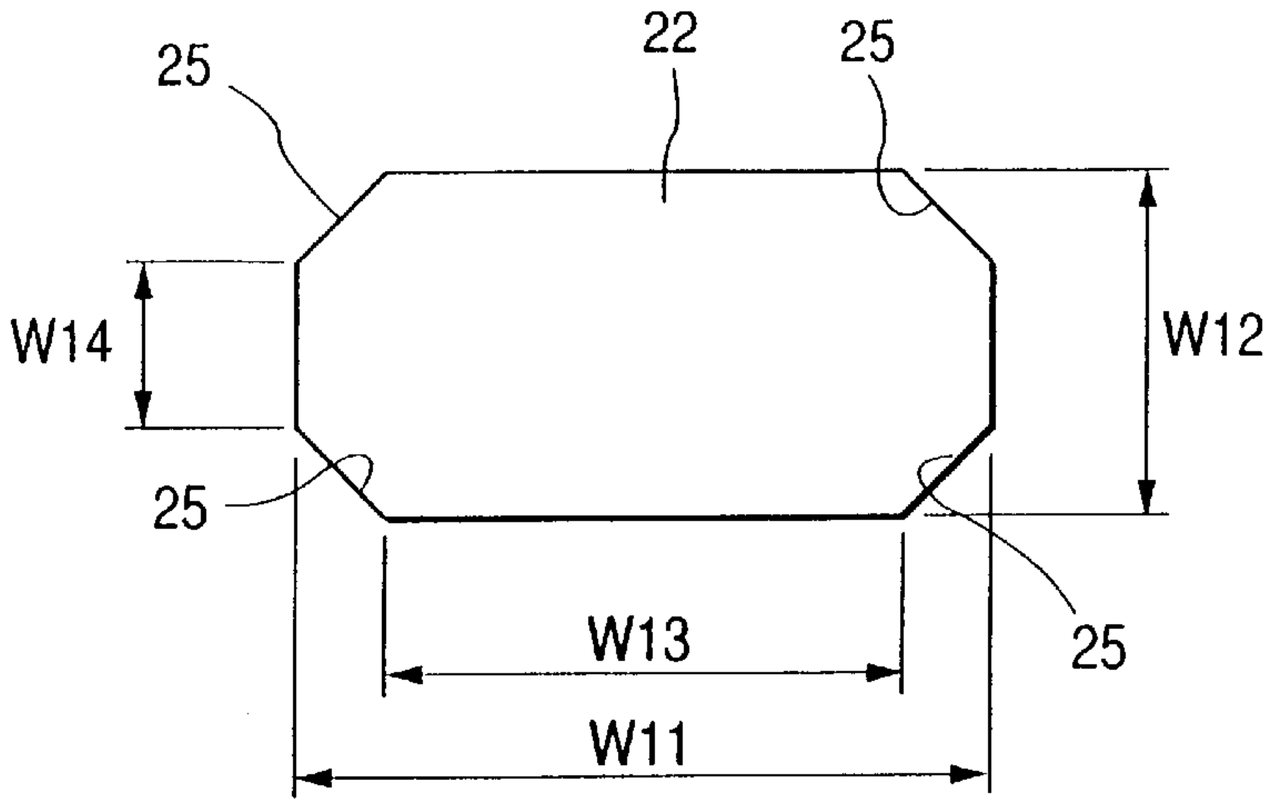


FIG. 6(a)

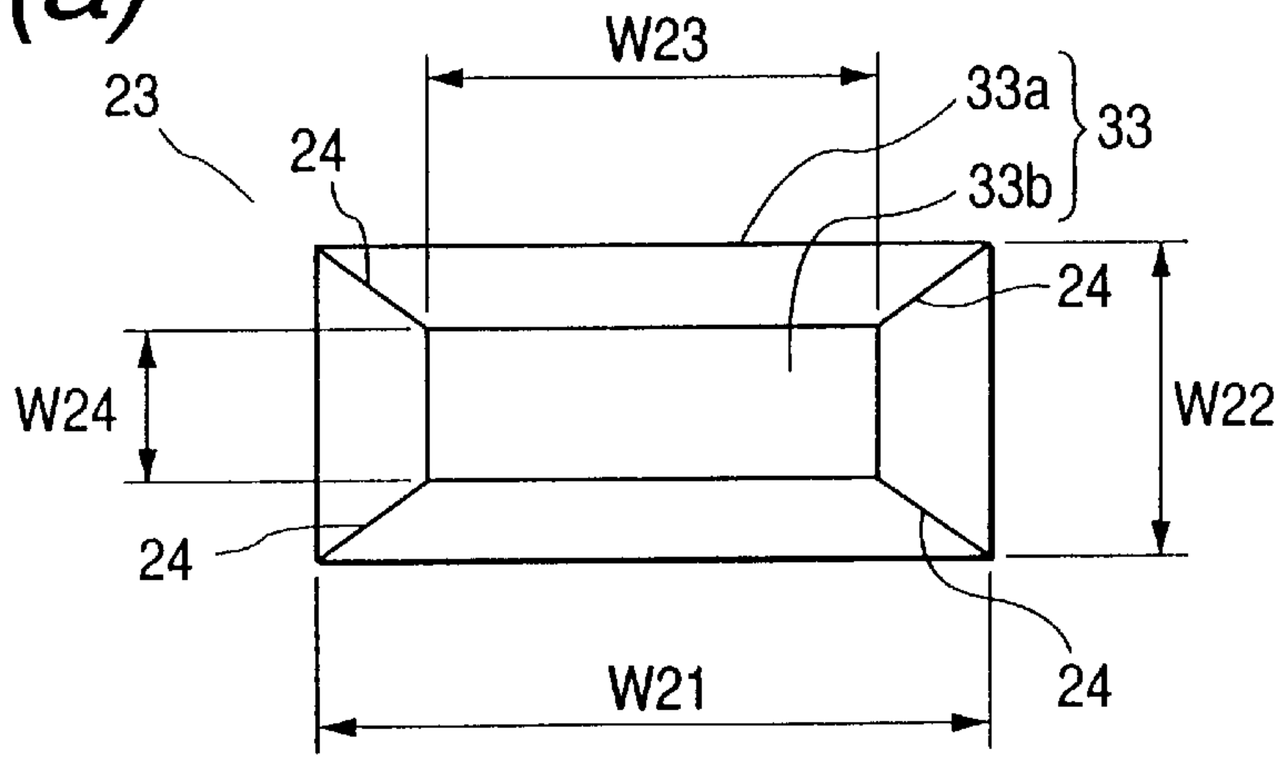


FIG. 6(b)

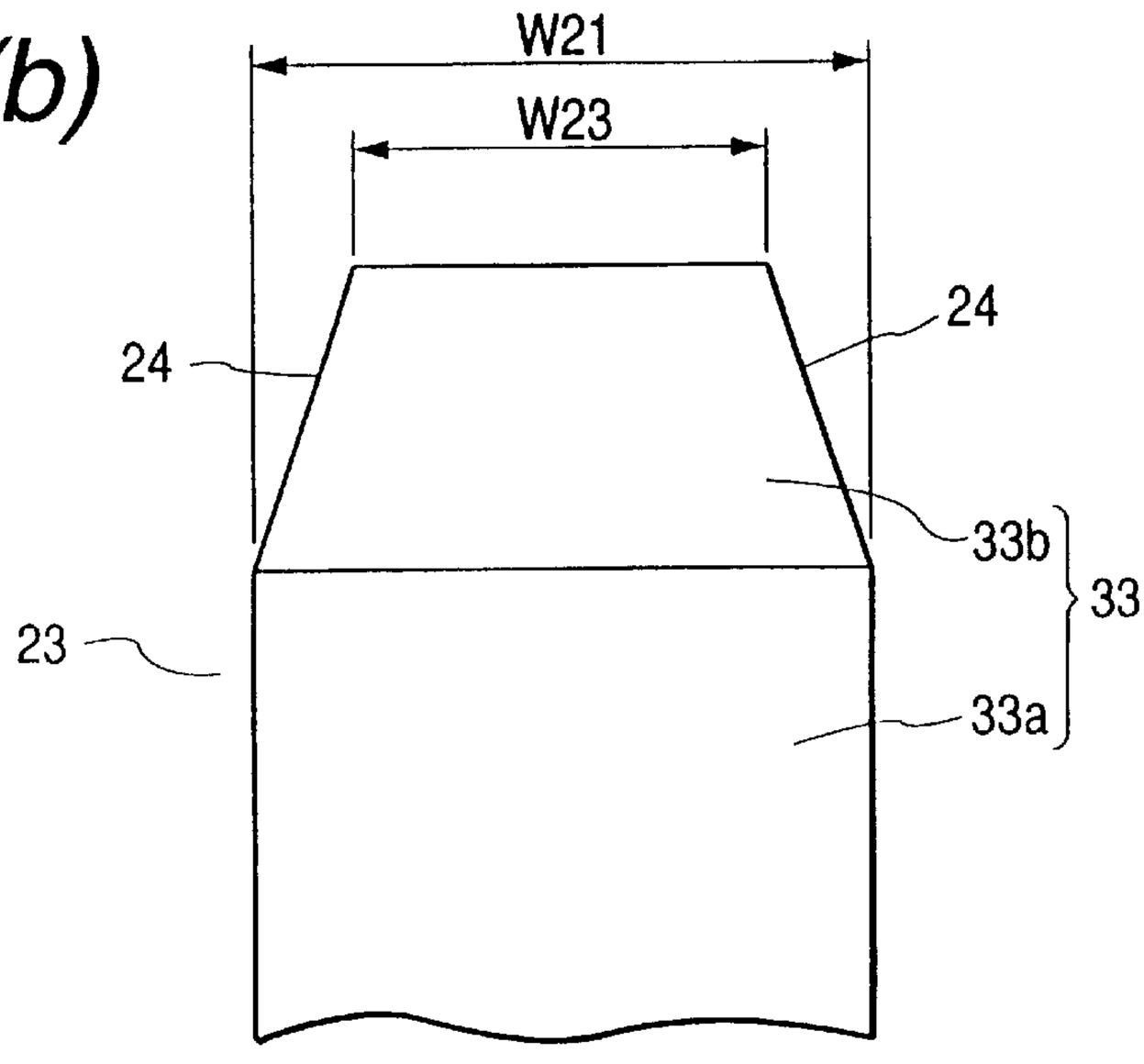


FIG. 7(a)

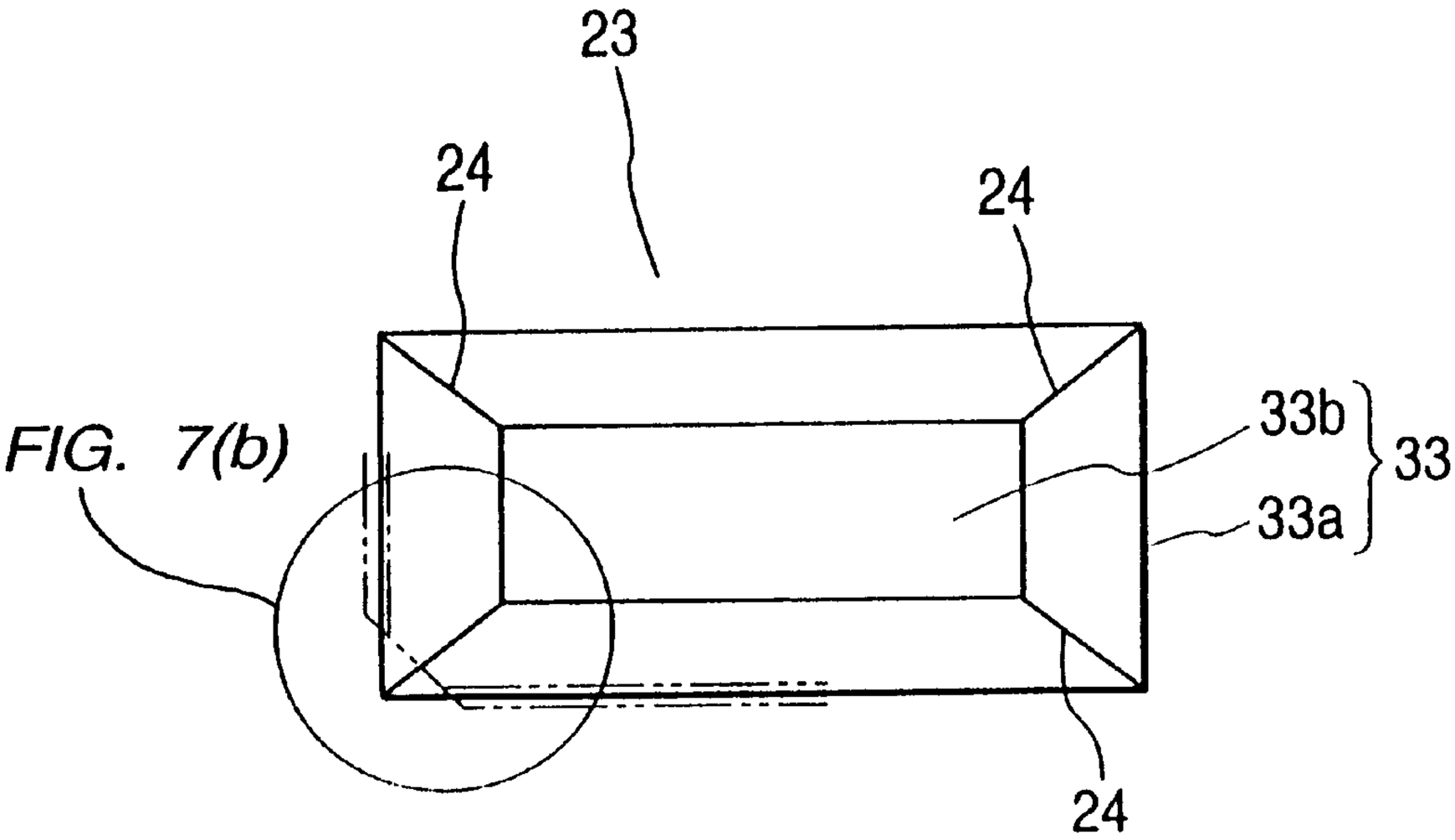


FIG. 7(b)

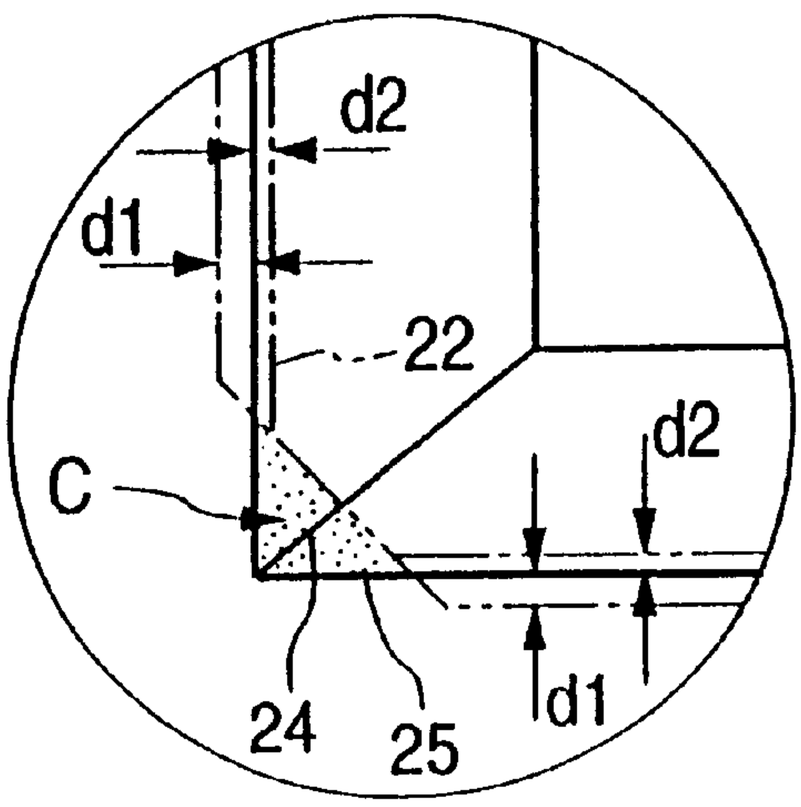


FIG. 8

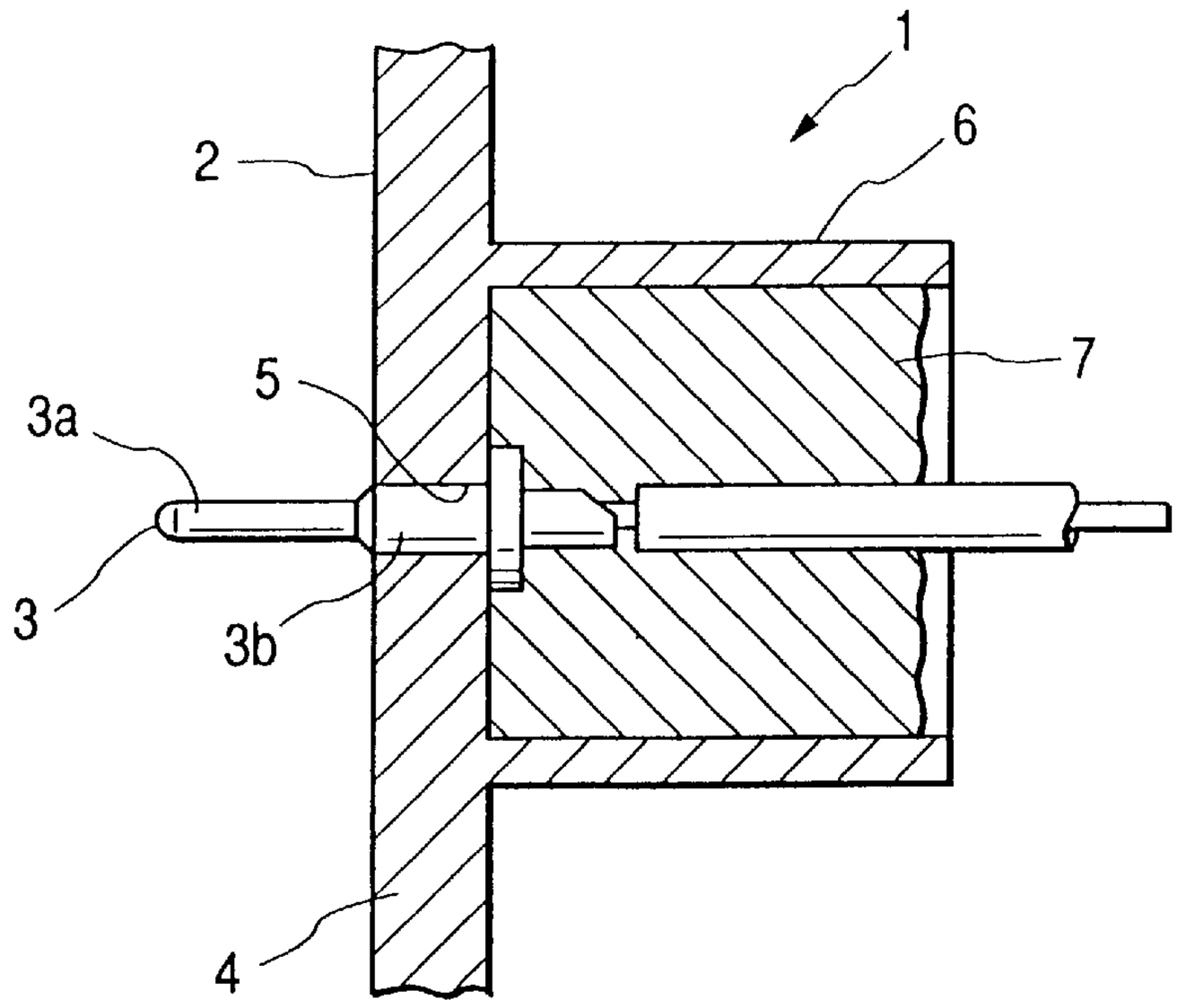


FIG. 9(a)

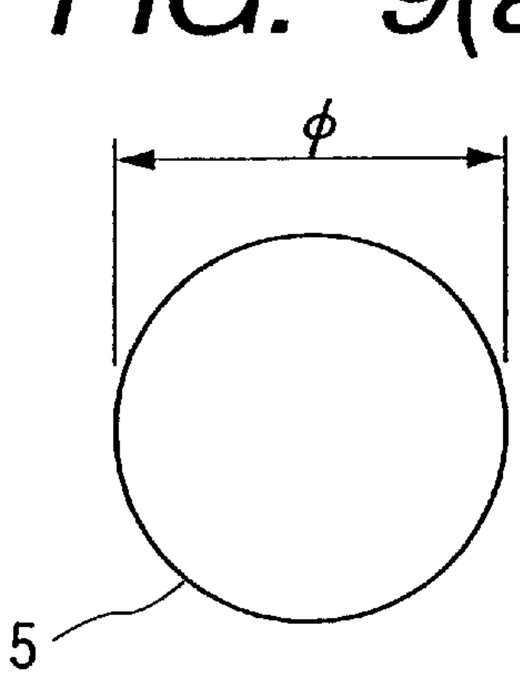


FIG. 9(b)

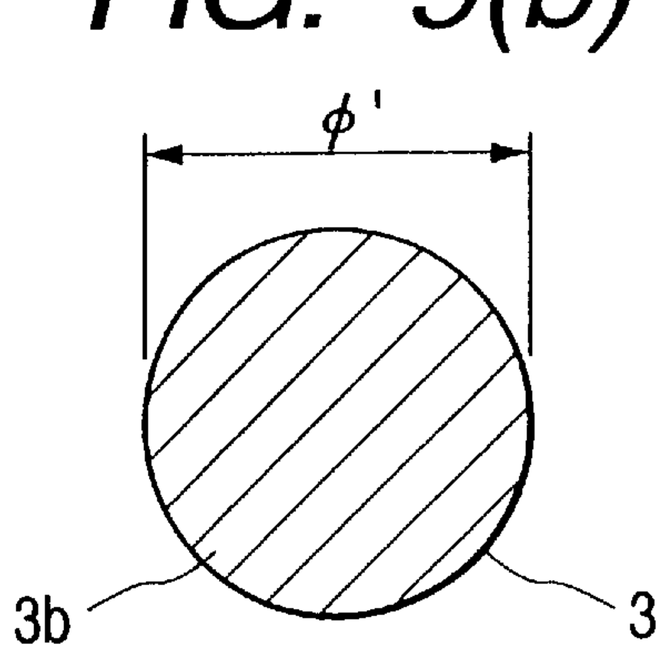


FIG. 10(a)

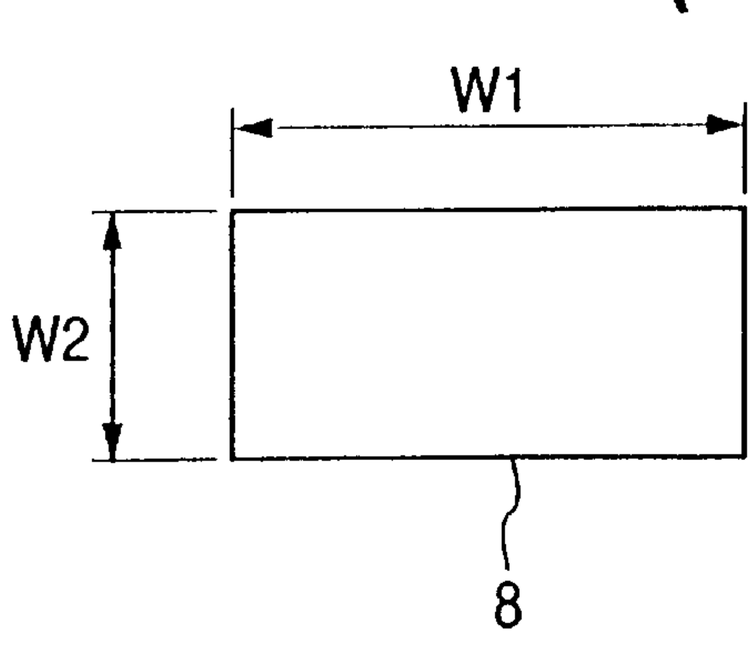
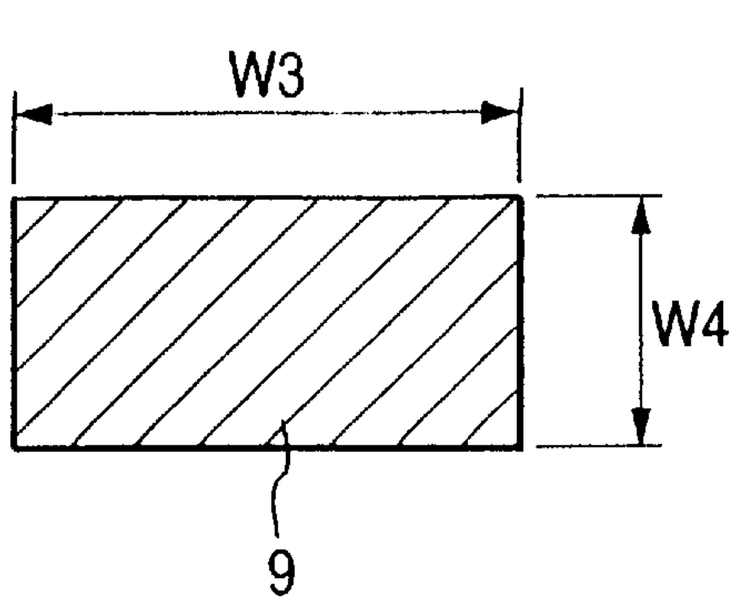


FIG. 10(b)



TERMINAL PRESS-FITTING CONSTRUCTION IN CONNECTOR HOUSING

BACKGROUND OF INVENTION

1. Field of the Invention

This invention relates to a terminal press-fitting construction including terminal press-fitting open holes, formed in a connector housing, and terminals inserted respectively in the terminal press-fitting open holes in a press-fitted manner.

2. Related art

A terminal press-fitting construction of the type described will be described with reference to FIG. **8**.

A connector **1** includes connector housing **2**, and male terminals **3** each having a round pin-shaped distal end portion **3***a* and a press-fitting portion **3***b*. In this terminal press-fitting construction, the male terminal **3** is press-fitted liquid-tight into a terminal press-fitting open hole **5** formed through an inner wall **4** of the connector housing **2**.

After the male terminal **3** is thus press-fitted, a potting resin **7** is filled in a tubular potting cup **6** formed on a rear side of the inner wall **4**, and the distal end portion **3***a* of the male terminal **3** projects from the front side of the inner wall **4** for electrical connection to a female terminal (not shown).

This terminal press-fitting construction in the connector **1** will be described in further detail. As shown in FIG. **9**(*a*), the terminal press-fitting open hole **5** has an opening with a diameter ϕ when viewed in the direction of the axis of the open hole **5**. As shown in FIG. **9**(*b*), the press-fitting portion **3***b* of the male terminal **3** has a transverse cross-section (perpendicular to the axis of the male terminal **3**) having a diameter ϕ'. The diameters ϕ and ϕ' are so determined that $\phi<\phi'$ is established, and the difference between the two diameters serves as a press-fitting amount, and the male terminal **3** is press-fitted and inserted into the terminal press-fitting open hole **5** while the press-fitting portion **3***b* forcibly expanding the terminal press-fitting open hole **5**.

The male terminal **3** is held in intimate contact with the inner surface of the terminal press-fitting open hole **5** to form a seal therebetween, thereby preventing the leakage of the potting resin **7** (see FIG. **8**).

Besides the terminal press-fitting construction employing the round pin-shaped terminals, there is also known a terminal press-fitting construction (as shown in FIGS. **10**(*a*) and **10**(*b*)) which includes terminal press-fitting open holes **8** of a rectangular cross-section (formed in a connector housing (not shown)), and tab-like male terminals **9** of a rectangular cross-section each for press-fitting into the associated terminal press-fitting open hole **8**.

Namely, an opening of the terminal press-fitting open hole **8** has a rectangular cross-section when viewed in the direction of the axis of the open hole **8**, and this open hole **8** has a width w**1** and a thickness w**2**. The male terminal **9** has a width w**3** and a thickness w**4**. These dimensions are so determined that w**1**<w**3** and w**2**<w**4** are established.

Therefore, the differences in these dimensions serve as a press-fitting amount, and as in the above terminal press-fitting construction (see FIG. **9**), the male terminal **9** is press-fitted and inserted into the terminal press-fitting open hole **8** while forcibly expanding the terminal press-fitting open hole **8**.

In the above conventional constructions, the terminal press-fitting open hole is forcibly expanded when press-fitting and inserting the male terminal thereinto, and therefore the operator is required to apply to the male terminal an inserting force larger than a compressive stress of a material (resin) of which the connector housing is made.

This inserting force acts on the terminal press-fitting open hole through the entire periphery of the male terminal, and therefore becomes a very large load, and when the inserting operation is effected for a long period of time, the efficiency of the operation is much lowered.

If the direction of press-fitting of the male terminal into the terminal press-fitting open hole does not fully coincide with the direction of application of the load by the operator, there is a possibility that the male terminal is deformed since the male terminal must be pressed into the terminal press-fitting open hole with a very large load as described above. This creates another cause of the lowered operation efficiency.

The sealing effect can be achieved by holding the male terminal and the inner surface of the terminal press-fitting open hole in intimate contact with each other, and therefore it is thought that the inserting force can be reduced by reducing the press-fitting amount as much as possible.

However, it is also necessary to provide the proper function of retaining the male terminal in position, and therefore in the above terminal press-fitting constructions, the press-fitting amount can not be reduced sufficiently regardless of the sealing effect.

Therefore, the above problems have not yet been solved, and there is still room for improvement.

SUMMARY OF INVENTION

The present invention has been made in view of the above problems, and an object of the invention is to provide a terminal press-fitting construction in a connector housing, in which the efficiency of the operation can be enhanced without affecting a terminal-retaining function while securing a proper sealing effect.

According to a first aspect of the present invention, a terminal press-fitting construction in a connector housing, which includes terminal press-fitting open holes, formed in the connector housing, and terminals inserted respectively in the terminal press-fitting open holes in a press-fitted manner; provided in that chamfered portions are formed on an inner surface of the terminal press-fitting open hole, and corner portions of the terminal abut respectively against the chamfered portions to slide respectively on the chamfered portions during a press-fitting operation so that the corner portions can achieve a press-fitting effect; and an opening of the terminal press-fitting open hole, when viewed in a direction of an axis thereof, has a polygonal shape having sides twice larger in number than the corner portions.

In the above construction, the corner portions of the terminal slide respectively on the chamfered portions of the terminal press-fitting open hole so as to achieve the press-fitting effect, and therefore these corner portions are held in line-contact with the terminal press-fitting open hole. Namely, when the terminal is inserted, the corner portions of the terminal first abut against the chamfered portions of the terminal press-fitting open hole, respectively, and then slide on these chamfered portions, respectively. Therefore,the terminal is not press-fitted through the entire periphery thereof in contrast with the conventional construction.

Therefore, at the time of starting the press-fitting operation, the terminal can be press-fitted (inserted) without applying to the terminal a large load as required in the conventional construction, and even if the press-fitting (inserting) operation is effected for a long period of time, it

will not become a burden to the operator. Therefore,the efficiency of the operation is markedly enhanced.

A half of the surfaces, forming the terminal press-fitting open hole, are the chamfered portions, and the terminal can be retained only by the chamfered portions, and therefore a press-fitting amount with respect to the remaining surfaces can be determined depending on whether or not a sealing effect is necessary.

Therefore, if the sealing effect is necessary, there is provided an arrangement in which the terminal can contact at least the remaining surfaces, and if the sealing effect is not necessary, a gap is formed therebetween so as to reduce the inserting force.

Therefore, there can be provided the terminal press-fitting construction in the connector housing, in which the efficiency of the operation can be enhanced without affecting the terminal-retaining function while securing the proper sealing effect.

The corner portion does not merely mean a corner of the terminal (that is, an edge portion), but means a corner portion including a surface and a radiused surface formed on the edge portion in the production.

In the terminal press-fitting construction (in the connector housing) of a second aspect of the present invention of according to the first aspect of the present invention, the opening of the terminal press-fitting open hole, when viewed in the direction of the axis thereof, has an octagonal shape, and a length of the terminal press-fitting open hole except the chamfered portions in a direction of a width thereof is shorter than a width of a tapering distal end portion of the terminal, and a length of the terminal press-fitting open hole except the chamfered portions in a direction of a thickness thereof is shorter than a thickness of the distal end portion.

In the above construction, the length of the terminal press-fitting open hole except the chamfered portions in the direction of the width thereof, the length of the terminal press-fitting open hole except the chamfered portions in the direction of the thickness thereof, and the width and thickness of the terminal are determined as described above, and therefore the corner portions positively abut against the chamfered portions, respectively, so that misalignment of the terminal can be kept to a minimum when inserting the terminal.

Therefore, the terminal can be press-fitted in a stable manner, and the efficiency of the operation can be enhanced.

In the terminal press-fitting construction (in the connector housing) of a third aspect according to the second aspect of the present invention, a total length of the terminal press-fitting open hole in the direction of the width thereof is slightly shorter than or equal to a width of a base portion of the terminal, and a total length of the terminal press-fitting open hole in the direction of the thickness thereof is slightly shorter than a thickness of the base portion.

In the above construction, the total length of the terminal press-fitting open hole in the direction of the width thereof, the total length of the terminal press-fitting open hole in the direction of the thickness thereof and the width and thickness of the base portion of the terminal are determined as described above, and therefore the terminal is positively sealed. The terminal is retained at the corner portions as described above, and therefore there can be adopted the above construction in which the sealing effect is regarded as being important. When a press-fitting amount is provided, the efficiency of the operation will not be affected if this press-fitting amount is kept as small as possible.

Therefore, the sealing effect is positively secured, and the efficiency of the operation is enhanced.

The total length means the length without the chamfered portions, and is equal to the distance between the parallel opposed surfaces.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of one preferred embodiment of a terminal press-fitting construction of the invention in a connector housing.

FIG. **2** is a plan view of the connector housing as viewed in a terminal inserting direction (An encircled portion is an enlarged view of an important portion).

FIG. **3** is a cross-sectional view of the connector housing taken along the line A—A of FIG. **2**.

FIG. **4** is a view of the connector housing as viewed in a direction of arrow B of FIG. **3** (An encircled portion is an enlarged view of an important portion).

FIG. **5** is a view explanatory of dimensions of a terminal press-fitting open hole in FIGS. **2** and **4**.

FIG. **6**(*a*) a front-elevational of a male terminal of FIG. **3**, showing its distal end portion, and FIG. **6**(*b*) is a plan view of the male terminal of FIG. **3**.

FIG. **7** is a view explanatory of the manner of press-fitting the terminal of FIG. **6**(*a*) into the terminal press-fitting open hole of FIG. **5**.

FIG. **8** is a cross-sectional view of a connector, showing a terminal press-connecting construction in a conventional connector housing.

FIG. **9**(*a*) is a view explanatory of a dimension of a terminal press-fitting open hole of FIG. **8**, and FIG. **9**(*b*) is a cross-sectional view of a male terminal of FIG. **8**.

FIG. **10**(*a*) is a view explanatory of dimensions of a terminal press-fitting open hole of other conventional construction than that of FIG. **9**(*a*), and FIG. **10**(*b*) is a cross-sectional view of other conventional male terminal than that of FIG. **9**(*b*).

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

One preferred embodiment of the present invention will now be described with reference to the drawings. FIG. **1** is a perspective view of one preferred embodiment of a terminal press-fitting construction of the invention in a connector housing.

FIG. **2** is a plan view of the connector housing as viewed in a terminal inserting direction (An encircled portion is an enlarged view of an important portion), FIG. **3** is a cross-sectional view of the connector housing taken along the line A—A of FIG. **2**, and FIG. **4** is a view of the connector housing as viewed in a direction of arrow B of FIG. **3** (An encircled portion is an enlarged view of an important portion).

In FIG. **1**, the terminal press-fitting construction of the invention (in the connector housing) includes terminal press-fitting open holes **22** formed in the connector housing **21**, and terminals **23** which are press-fitted and inserted into the terminal press-fitting open holes **22**, respectively. In one example, four chamfered portions **25** are formed on an inner surface of the terminal press-fitting open hole **22**, and four corner portions **24** of the male tab-like terminal **23** about respectively against the chambered portions **25** to slide respectively on these chamfered portions **25** during a press-fitting operation so that the corner portions **24** can achieve the press-fitting effect. An opening of the terminal press-fitting open hole **22**, when viewed in a direction of the axis

thereof, has a polygonal (i.e., octagonal) shape having sides twice larger in number than the corner portions **24**. The terminal **23** is inserted into this opening.

The connector housing **21** will be described more specifically with reference to FIGS. **2** to **5**.

As shown in FIGS. **2** and **3**, the connector housing **21** is made of a synthetic resin, and is formed into a generally cylindrical shape. A plurality of terminal receiving chambers **26** are formed within the connector housing at a generally central portion thereof. A cup-shaped bulge portion **27** (see FIG. **3**), larger in diameter than that portion of the connector housing **21** having the terminal receiving chambers **26**, is formed at a rear portion of the connector housing **21**, that is, at the rear side of the terminal receiving chambers **26** from which the terminals **23** (see FIG. **3**) are inserted. A fitting portion **28** (see FIGS. **3** and **4**) of a generally rectangular shape for fitting on a mating connector (not shown) is formed at a front portion of the connector housing.

The terminal receiving chambers **26** are separated from one another by cross-sectionally L-shaped guides **29**, and the terminal press-fitting open holes **22** are formed through a partition wall **30** formed between the fitting portion **28** (see FIGS. **3** and **4**) and the terminal receiving chambers **26**. Because of the provision of the chamfered portions **25**, the opening of the terminal press-fitting open hole **22**, when viewed in the direction of the axis thereof, has an elongate octagonal shape much like a rectangular shape with four corner portions cut off. The terminal press-fitting open hole **22**, having such a shape throughout the length thereof, communicates the terminal receiving chamber **26** with the fitting portion **28** (see FIG. **3**).

The terminal press-fitting open hole **22** will be described in further detail. As shown in FIG. **5**, the open hole **22** has a total length (width) **W11** in the direction of the width thereof (corresponding to the direction of the width of the terminal **23**), and a total length (thickness) **W12** in the direction of the thickness thereof (corresponding to the direction of the thickness of the terminal **23**). A length of the open hole **22** except the chamfered portions **25** in the direction of the width is represented by **W13**, and a length of the open hole **22** except the chamfered portions **25** in the direction of the thickness is represented by **W14**. The inclination of the chamfered portions **25** can be suitably determined by changing the length **W13** or the length **W14**.

As will be appreciated from the above description and the drawings, the total lengths mean the lengths of the sides of the rectangle without the chamfered portions **25**, and the total length (width) is equal to the distance between the opposed shorter sides, and the total length (thickness) is equal to the distance between the opposed longer sides.

As shown in FIG. **3** which is a side-elevational view, the terminal **23** to be inserted into the terminal press-fitting open hole **22** includes a wire connecting portion **32** for being pressed to hold a wire **31**, and a male tab-like electrical contact portion **33** extending from the wire connecting portion **32**. The terminal **23** is formed by pressing a metal sheet of good electrical conductivity into a predetermined shape.

As shown in FIGS. **6**(*a*) and **6**(*b*), the electrical contact portion **33** includes a base portion **33***a* , and a tapering distal end portion **33***b* . The electrical contact portion **33** has a rectangular transverse cross-section, and therefore has four corner portions **24**.

The base portion **33***a* has a width **W21** and a thickness **W22**, and the distal end portion **33***b* has a width **W23** and a thickness **W24**.

The corner portion **24** does not merely mean a corner of the terminal **23** (that is, an edge portion extending continuously over the base portion **33***a* and the distal end portion **33***b*), but means a corner portion including a surface and a radiused surface formed on the edge portion in the production.

In the above construction, the dimensional relation between the terminal press-fitting open hole **22** and the electrical contact portion **33** is as follows (see FIGS. **5** and **6**).

The length **W13** of the terminal press-fitting open hole **22** in the direction of the width is shorter than the width **23** of the distal end portion **33***b* (**W13<W23**), and the length **W14** of the terminal press-fitting open hole **22** in the direction of the thickness is shorter than the thickness **W24** of the distal end portion **33***b* (**W14<W24**).

The total length **W11** of the terminal press-fitting open hole **22** in the direction of the width is slightly shorter than or equal to the width **W21** of the base portion **33***a* (**W11≦W21** (**W11_W21** may be acceptable)), and the total length **W12** of the terminal press-fitting open hole **22** in the direction of the thickness is slightly shorter than or equal to the thickness **W22** of the base portion **33***a* (**W12≦W22** (**W12_W22** may be acceptable)).

In this dimensional relation, when the terminal **23** is inserted into the terminal receiving chamber **26** as shown in FIG. **3**, the corner portions **24** (see FIG. **7**) are brought into contact with the chamfered portions **25**, respectively, at four points, and then slide respectively on the chamfered portions **25** (in line-contact therewith) to forcibly expand the chamfered portions **25**. Overlapping portions (indicated by arrow C) of each corner portion **24** and the associated chamfered portion **25** contribute to the retaining of the terminal **23**, and therefore the terminal is maintained in a stably-retained condition.

If it is not necessary to take the sealing effect into consideration, a gap d**1** is formed between the terminal press-fitting open hole **22** and the base portion **33***a* so as to greatly reduce the force required for inserting the terminal **23**. In contrast, in this embodiment, the above dimensional relation is so determined as to provide the sealing construction, and therefore in this terminal press-fitting construction, the base portion **33***a* is held in contact with the terminal press-fitting open hole **22**, or is compressed in an amount d**2**. This compression amount d**2** can be determined without taking the retaining of the terminal **23** into consideration, and therefore can be made as small as possible so as to reduce the inserting force.

As described above, the corner portions **24** of the terminal **23** slide respectively on the chamfered portions **25** of the terminal press-fitting open hole **22** so as to achieve the press-fitting effect, and in this terminal press-fitting construction, the male terminal is not press-fitted through the entire periphery of the male terminal in contrast with the conventional construction in which the press-fitting insertion is effected through the entire periphery of the conventional male terminal **3** (see FIG. **8**).

Therefore, at the time of starting the press-fitting operation, the terminal **23** can be press-fitted (inserted) without applying to the terminal **23** a large load as required in the conventional construction, and even if the press-fitting (inserting) operation is effected for a long period of time, it will not become a burden to the operator.

In the above dimensional relation, the corner portions **24** positively abut against the chamfered portions **25**, respectively, and therefore when inserting the terminal **23**,

misalignment of the terminal **23** can be kept to a minimum, and the terminal **23** can be press-fitted in a stable manner. And besides, the sealing effect can be positively secured.

Therefore, there can be provided the terminal press-fitting construction in the connector housing, in which the efficiency of the operation is markedly enhanced.

In the present invention, various modifications can be made without departing from the scope of the invention.

The cross-section of the male terminals is not limited to a square shape, but can be a triangular shape, a hexagonal shape and other shape. The present invention can be applied to a construction in which a female terminal or a male terminal of other form is retained in each terminal receiving chamber.

As described above, in the present invention, the corner portions of the terminal slide respectively on the chamfered portions of the terminal press-fitting open hole so as to achieve the press-fitting effect, and therefore these corner portions are held in line-contact with the terminal press-fitting open hole. Namely, when the terminal is inserted, the corner portions of the terminal first abut against the chamfered portions of the terminal press-fitting open hole, respectively, and then slide on these chamfered portions, respectively. Therefore, the terminal is not press-fitted through the entire periphery thereof in contrast with the conventional construction.

Therefore, at the time of starting the press-fitting operation, the terminal can be press-fitted (inserted) without applying to the terminal a large load as required in the conventional construction, and even if the press-fitting (inserting) operation is effected for a long period of time, it will not become a burden to the operator. Therefore, the efficiency of the operation is markedly enhanced.

A half of the surfaces, forming the terminal press-fitting open hole, are the chamfered portions, and the terminal can be retained only by the chamfered portions, and therefore a press-fitting amount with respect to the remaining surfaces can be determined depending on whether or not a sealing effect is necessary.

Therefore, if the sealing effect is necessary, there is provided an arrangement in which the terminal can contact at least the remaining surfaces, and if the sealing effect is not necessary, a gap is formed therebetween so as to reduce the inserting force.

Therefore, advantageously, there can be provided the terminal press-fitting construction in the connector housing, in which the efficiency of the operation can be enhanced without affecting the terminal-retaining function while securing the proper sealing effect.

In the present invention, the length of the terminal press-fitting open hole except the chamfered portions in the direction of the width thereof, the length of the terminal press-fitting open hole except the chamfered portions in the direction of the thickness thereof, and the width and thickness of the terminal are determined as described above, and therefore the corner portions positively abut against the chamfered portions, respectively, so that misalignment of the terminal can be kept to a minimum when inserting the terminal.

Therefore, advantageously, the terminal can be press-fitted in a stable manner, and the efficiency of the operation can be enhanced.

In the present invention, the total length of the terminal press-fitting open hole in the direction of the width thereof, the total length of the terminal press-fitting open hole in the direction of the thickness thereof and the width and thickness of the base portion of the terminal are determined as described above, and therefore the terminal is positively sealed. The terminal is retained at the corner portions as described above, and therefore there can be adopted the above construction in which the sealing effect is regarded as being important. When a press-fitting amount is provided, the efficiency of the operation will not be affected if this press-fitting amount is kept as small as possible.

Therefore, advantageously, the sealing effect is positively secured, and the efficiency of the operation is enhanced.

What is claimed is:

1. A terminal press-fitting construction comprising:

a connector housing including press-fitting open holes;

terminals inserted respectively in said terminal press-fitting open holes in a press-fitted manner;

chamfered portions formed on an inner surface of said terminal press-fitting open hole, and corner portions of said terminal abut respectively against said chamfered portions to slide respectively on said chamfered portions during a press-fitting operation so that said corner portions can achieve a press-fitting effect, and an opening of said terminal press-fitting open hole, when viewed in a direction of an axis thereof, having a polygonal shape having sides twice larger in number than said corner portions.

2. A terminal press-fitting construction in a connector housing according to claim **1**, wherein the opening of said terminal press-fitting open hole, when viewed in the direction of the axis thereof, has an octagonal shape, and a length of said terminal press-fitting open hole except said chamfered portions in a direction of a width thereof is shorter than a width of a tapering distal end portion of said terminal, and a length of said terminal press-fitting open hole except said chamfered portions in a direction of a thickness thereof is shorter than a thickness of said distal end portion.

3. A terminal press-fitting construction in a connector housing according to claim **2**, wherein a total length of said terminal press-fitting open hole in the direction of the width thereof is slightly shorter than or equal to a width of a base portion of said terminal, and a total length of said terminal press-fitting open hole in the direction of the thickness thereof is slightly shorter than a thickness of said base portion.

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